ASSIGNMENT 1

Textbook Assignment: "Convergence, Divergence, and Vorticity," "Forecasting Upper Air Systems," and "Forecasting Surface Systems." Pages 1-1 through 3-10.

1-1. Maximum convergence and divergence occurs between what levels aloft?

1. 850- to 700-hPa levels
2. 700- to 500-hPa levels
3. 500- to 300-hPa levels
4. 300- to 200-hPa levels

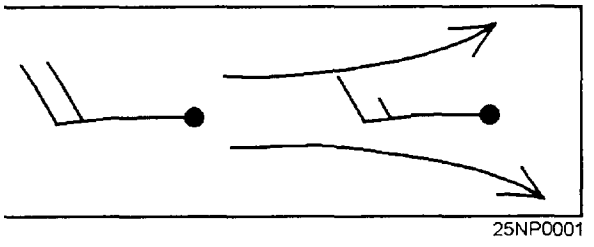

Figure 1-A

IN ANSWERING QUESTION 1-2, REFER TO FIGURE 1-A.

1-2. The wind symbols and streamlines in Figure 1-A depict what information?

1. Speed divergence and directional divergence
2. Speed convergence and directional divergence
3. Speed divergence and directional convergence
4. Speed convergence and directional convergence

1-3. The "advection" stratum may be regarded as the stratum below what specific level?

1. The 200-hPa level
2. The 300-hPa level
3. The 400-hPa level
4. The 500-hPa level

1-4. If all other motions of convergence and divergence are neglected, rising and falling heights at the isopycnic level are the result of what actions?

1. Rising heights are due to subsidence, and falling heights are due to convection
2. Rising heights are due to convection, and falling heights are due to subsidence
3. Rising heights are due to divergence above the isopycnic level, and falling heights are due to convergence above the isopycnic level
4. Rising heights are due to convergence above the isopycnic level, and falling heights are due to divergence above the isopycnic level

1-5. The level of maximum velocity convergence, located between the 300- and 200-hPa levels, is the primary cause of which of the following conditions?

1. Pressure rises at the surface
2. pressure falls at the surface
3. Height rises in the upper troposphere and lower stratosphere
4. Height falls in the upper troposphere and lower stratosphere

1-6. Assume that the vertical motion is upward and is a result of low-level convergence. This is indicative of what type of circulation?

1. Lower vertical circulation in an anticyclone
2. Upper vertical circulation in an anticyclone
3. Lower vertical circulation in advance of a low
4. Upper vertical circulation in advance of a low

1-7. Maximum horizontal divergence occurs at approximately what pressure level?

1. The 500-hPa level
2. The 400-hPa level
3. The 300-hPa level
4. The 150-hPa level

1-8. What is the result of stratospheric flow over a developing cyclone?

1. Downward vertical motion, and convergence at the level of maximum horizontal divergence
2. Upward vertical motion, and divergence at the level of maximum horizontal divergence
3. Upward vertical motion, and convergence at the level of maximum horizontal divergence
4. Downward vertical motion, and divergence at the level of maximum horizontal divergence

1-9. You are looking downstream and find that high-speed winds are moving towards weak, cyclonically curved contours. What effect should this have on upper-level heights?

1. Heights should decrease downstream to the left
2. Heights should decrease downstream to the right
3. Heights should increase downstream to the left
4. Heights should increase downstream to the right

1-10. When an anticyclonic circulation center is out of phase with its pressure center, what movement(s) bring(s) about a readjustment?

1. The movement of the circulation and pressure centers toward each other
2. The movement of the circulation center toward the pressure center
3. Both 1 and 2 above
4. The movement of the pressure center toward the circulation center

1-11. You encounter a well-developed ridge that has sharply curved anticyclonic contours with a deep trough a short distance downstream. What action should you expect to take place?

1. Deepening and reorientation of a portion of the trough
2. The cutoff low to retrograde from its position and the trough to reorient
3. Dissipation of the low at the lower end of the trough, depending on the initial winds in the ridge to the west
4. Filling and reorientation of the trough

1-12. Under what condition does the greatest overshooting of high-speed winds occur?

1. When high-speed winds in the ridge are more than twice the measured geostrophic winds
2. When measured geostrophic winds in the ridge are more than twice the high-speed winds in the ridge
3. When low-speed winds approach the west side of the anticyclonic ridge
4. When low-speed winds are located in the southwesterly flow of the downstream ridge

1-13. Convergence on the western side of a downstream trough has what results?

1. Dynamic heating
2. A decrease in upper-level heights
3. An increase in upper-level heights
4. A decrease in moisture

1-14. Which of the following statements concerning the convection process is valid?

1. Air-mass stability is increased by the process
2. Air-mass stability is decreased by the process
3. The air mass is compressed
4. Stratiform type clouds predominate in areas of convection

1-15. Upward motion will always result in cloudiness.

1. True
2. False

1-16. When relative vorticity is evaluated, which of the following components of rotational motion should be considered?

1. Wind shear and streamline curvature
2. Wind shear and atmospheric rotation
3. Streamline curvature and atmospheric rotation
4. Atmospheric rotation and cyclostrophic motion

IN ANSWERING QUESTION 1-17, REFER TO FIGURE 1-4 IN YOUR TRAMAN.

1-17. In evaluating relative vorticity from the shear effect alone on straight contours in the northern hemisphere, which evaluations of relative vorticity should you make?

1. Parcel No. 1 has anticyclonic or negative vorticity; Parcel No. 2 has cyclonic or positive vorticity; Parcel No. 3 has zero vorticity
2. Parcel No. 1 has zero vorticity; Parcel No. 2 has anticyclonic or negative vorticity; Parcel No. 3 has cyclonic or positive vorticity
3. Parcel No. 1 has cyclonic or positive vorticity; Parcel No. 2 has anticyclonic or negative vorticity; Parcel No. 3 has zero vorticity
4. Parcel No. 1 has zero vorticity; Parcel No. 2 has cyclonic or positive vorticity; Parcel No. 3 has anticyclonic or negative vorticity

IN ANSWERING QUESTION 1-18, REFER TO FIGURE 1-5 IN YOUR TRAMAN.

1-18. When you are considering the curvature effect alone for an evaluation of relative vorticity, point P is considered to be a point of NO curvature and, therefore, zero vorticity. What is another name for this point of NO curvature?

1. Mid-point of vorticity
2. Point of negative vorticity
3. Point of positive vorticity
4. Inflection point

IN ANSWERING QUESTION 1-19, REFER TO FIGURE 1-9 IN YOUR TRAMAN.

1-19. If only the curvature effect were considered, the relative vorticity would increase in which of the following regions?

1. Regions I and II
2. Regions I and IV
3. Regions II and III
4. Regions III and IV

1-20. When relative vorticity is decreasing downstream in the upper troposphere, what should you expect to occur?

1. Convergence aloft and surface pressure falls
2. Decreased precipitation if sufficient moisture was initially present
3. Decreased thicknesses between standard isobaric surfaces in the region of decreasing relative vorticity
4. Divergence aloft and surface pressure falls

1-21. Long waves of relatively short wavelength, well-defined major troughs and ridges, and well-developed surface cyclones and anticyclones are associated with which of the following wave patterns?

1. Changing long-wave patterns
2. Retrogression of long waves
3. Progressive long waves
4. Stationary long waves

1-22. Which of the following conditions would NOT be an indication of the retrogression of a long wave?

1. Increased cold air advection in the upstream ridge
2. 24-hr height change trajectories do not correspond to the band of maximum winds
3. New height centers appear
4. Surface lows to the west of the major trough position deepen

1-23. Which of the following statements is generally valid when poleward moving jet streams move into the upper midlatitudes?

1. The amplitudes of the long waves decrease
2. Low zonal indexes are reversed
3. The number of long waves increases
4. Associated long waves speed up

1-24. When changes in intensity of troughs and ridges aloft are forecast, the time differential chart is most valuable in forecasting which of the following features?

1. Surface pressure centers
2. Single height change centers with no apparent history
3. Height change centers due to convergence or divergence not associated with a short wave trough or ridge
4. Height change centers with a well-defined history that are associated with short wave troughs and ridges

1-25. You are trying to determine the change in intensity of a long wave trough and you notice that the warm air advection on the east side of the trough is less than the cold air advection on the west side. What intensity change, if any, should you forecast for this trough?

1. It will fill snowy
2. It will deepen
3. It will fill rapidly
4. None

1-26. Which of the following conditions is favorable for the filling of a trough?

1. The strongest winds are on the west side of the trough
2. The strongest winds are on the east side of the trough
3. The strongest winds are at the crest of the associated ridge
4. The strongest winds are in the southern quadrant of the trough

1-27. Upper height falls are associated with low-speed winds approaching straight or cyclonically curved contours.

1. True
2. False

1-28. What seasonal movement and intensity changes occur with the semipermanent high-pressure centers?

1. A poleward movement and decrease in intensity in the summer
2. An equatorward movement and decrease in intensity in the summer
3. A poleward movement and increase in intensity in the summer
4. An equatorward movement and increase in intensity in the summer

1-29. A blocking high at 500-hPa has several closed contours, and the strongest winds in these contours are to the south in the easterlies. What forecast should you make for this high?

1. It will move slowly eastward
2. It will move slowly westward
3. It will move rapidly eastward
4. It will remain stationary

1-30. Intensification of a blocking high will occur under which of the following conditions?

1. During high zonal index conditions
2. When cold air advection and mass convergence occur in the lower troposphere
3. When warm air advection and mass divergence occur in the upper troposphere
4. When cold air advection and mass convergence occur in the upper troposphere

1-31. Concerning the extrapolation of closed lows, which of the following statements is NOT accurate?

1. Extrapolation should only be used for their movement
2. A central height trend over time should be established
3. Changes in intensity may be determined
4. Extrapolation should be used in conjunction with other methods

1-32. A deep low is situated at 50°N, and the closed contours are nearly circular around the center. The strongest winds south of the low have a speed of 50 knots, and from these winds to the center of the low is 5° of latitude. The wind speed to the north of the low is 30 knots. According to the Eccentricity Formula, this low should move in what manner?

1. Eastward at 5.5 knots
2. Westward at 5.5 knots
3. Westward at 1.8 knots
4. Eastward at 1.8 knots

1-33. Which of the following statements is valid concerning the isotherm-contour relationship of lows aloft?

1. If isotherms and contours are out of phase, lows will remain stationary
2. Cold air advection to the west indicates weakening
3. Warm air advection to the east indicates filling
4. Cold air advection to the west indicates retrogression

1-34. The Time-Differential chart shows no height rises for a particular ridge you are forecasting at the 500-hPa level. The 300-hPa chart indicates high-speed winds in the northwestern portion of the ridge approaching anticyclonically curved, weak contours. The advection between the 1000- and 500-hPa levels in that portion of the ridge is warm. What should you forecast for this ridge?

1. The ridge should weaken slowly
2. The ridge should intensify
3. The ridge should weaken rapidly
4. The ridge should remain at its present intensity

1-35. In forecasting the intensity of a particular low, you discover that a jet maximum is located to the west of the low, and it is preceded by another jet maximum downstream beyond the southern periphery of the low. What should you forecast for this low?

1. The low should fill
2. The low should intensify rapidly
3. The low should intensify slowly
4. The low should remain at its present intensity

1-36. Which of the following conditions is NOT an indication that a cutoff low is forming aloft?

1. Height falls are moving south or southeastward
2. Strong cold air advection is on the west side of the trough
3. Strong southwesterlies are situated on the eastern side of the trough
4. Strong northerlies are situated on the western side of the trough

1-37. In the construction of forecasted 500-hPa contours, the change in intensity of a particular system is correlated with all EXCEPT which of the following factors to arrive at specific values for these contours?

1. The sign and the amount of rise and fall in the centers
2. Convergence and divergence at 500-hPa
3. Advection of 50% of the thickness gradient
4. Convergence and divergence in the 850- to 700-hPa stratum

1-38. The comma-shaped cloud formation found on satellite imagery is normally the result of upward motion produced by positive vorticity advection.

1. True
2. False

1-39. The 700-hPa chart is used in the construction of an advection chart for which of the following reasons?

1. It is the most readily available
2. It contains data considered to be the most accurate of any upper-level chart
3. It approximates the contours of the mean wind vector between the 1000- and 500-hPa levels
4. It is considered to be the steering level for cold core highs

1-40. What is the first step you should take when forecasting the movement of pressure systems?

1. Consult your station’s Forecaster’s Handbook
2. Refer to your constructed 1000-500-hPa thickness chart
3. Note the past history of the pressure system
4. Note the thermal characteristics of the pressure system

1-41. If the path of a cyclone indicates its future movement will run into a stationary anticyclone over the eastern Pacific Ocean, which of the following conditions may occur?

1. Its speed will increase, and its path will curve northward paralleling the isobars of the high
2. Its speed will decrease, and it will become quasi-stationary and probably dissipate
3. Its speed will decrease, and its path will curve northward, paralleling the isobars of the high
4. Its speed will decrease, and its path will be perpendicular to the isobars of the high

1-42. Anticyclone centers tend to move toward which of the following areas?

1. Toward the area of greatest pressure rises
2. Toward the area of greatest pressure falls
3. Toward the area of maximum low-level convergence
4. Toward the warm sector isobars

1-43. Warm unoccluded lows move in the general direction of the current in the warm air. What general statement is valid regarding their paths and speed?

1. They usually have straight paths, and their speed is approximately the same as that of the cold front
2. They usually have straight paths, and their speed is somewhat faster than that of the warm air
3. They usually have straight paths, and their speed is about the same as that of the warm air
4. They usually have straight paths, and their speed is somewhat slower than that of the warm air

1-44. Which pressure systems should be considered first when the steering method is used?

1. Warm highs and cold lows
2. Warm highs and warm lows
3. Cold highs and warm lows
4. Cold highs and cold lows

1-45. Assume you are using the steering method to forecast the movement of surface systems in relation to the upper level flow. Where possible, what upper level(s) should you use?

1. Use the 700-hPa level only
2. Use the 500-hPa level only
3. Integrate the results of the 500- and 300-hPa levels
4. Integrate the results of the movement and speed from the 700- and 500-hPa levels

1-46. Assume you are forecasting the movement and speed of a surface low. The upper level winds for the 700-hPa stratum are northwesterly at 20 knots. YOU should forecast this low to move in what manner?

1. In an unknown direction, at a speed of 14 knots
2. In an unknown direction, at a speed of 20 knots
3. Southeastward at 20 knots
4. Southeastward at 14 knots

1-47. When the 500-hPa chart is used for steering a surface system, the orientation of the contours determines the direction of motion. What factor should be used to compute the speed?

1. 50% of the forecast upstream winds for the 24-hr period
2. 50% of the forecast downstream winds for the 24-hr speed
3. 70% of the forecast downstream winds for the 24-hr speed
4. 70% of the forecast upstream winds for the 24-hr speed

1-48. Warm, unoccluded lows tend to move in what direction in relation to the steering current aloft?

1. Slightly to the left of it
2. Slightly to the right of it
3. At right angles to it
4. Parallel to it

1-49. Assume that in an unoccluded low the thickness gradient and the mean wind flow are both strong. In what direction should you expect the low to move?

1. Closer to the direction of the mean wind flow than the thermal wind
2. Closer to the direction of the thermal wind than the mean flow
3. Midway between the direction of the mean flow and the direction of the thickness contours

1-50. Surface lows move with approximately what percent of the thermal wind in the 1000- to 700-hPa stratum?

1. 50%
2. 75%
3. 80%
4. 100%

1-51. Relative to the use of statistical studies in forecasting, which of the following statements is accurate?

1. Valid statistical studies provide the forecaster with virtually infallible rules in making long range forecasts
2. Statistical studies are of little value to the forecaster in predicting the future behavior of storms, as they are mainly for climatological purposes
3. Valid statistical studies should be scrutinized and weighed in light of other factors in the integrated forecast
4. Once a weather situation has been identified, the forecaster can assume the feature will behave in an identical manner

1-52. The objective technique for the prediction of maritime cyclones may be employed for which of the following periods?

1. All maritime cyclones in all seasons of the year
2. All maritime cyclones during the winter months only
3. All maritime cyclones during the summer months only
4. Maritime cyclones whose initial positions are north of 30° latitude during the winter months

1-53. During periods of westerly flow aloft, surface highs tend to migrate in what general manner?

1. Toward the east
2. Poleward
3. Toward areas of decreasing isallobaric gradient
4. Equatorward

1-54. When the direction of movement of a surface low is parallel to the warm sector isobars, it can be expected to deepen with a rate equal to which of the following location pressure tendencies?

1. The warm sector tendency
2. The tendency in advance of the warm front
3. The tendency at the trough line
4. The tendency north of the center of the low

1-55. Wave cyclones are most likely to develop along a front in what location?

1. Along the accelerating portion of a cold front where the 700-hPa winds are parallel to the front
2. Along the decelerating portion of a cold front where the 700-hPa winds are parallel to the front
3. Along the decelerating portion of a cold front where the 700-hPa winds are perpendicular to the front
4. Along the accelerating portion of a cold front where the 700-hPa winds are perpendicular to the front

1-56. A change in pressure at the surface can be estimated to be equal to which of the following conditions?

1. A change in pressure at some level aloft
2. A change in mass between the surface and some upper level
3. A change in pressure at some upper level plus the change in mass between the surface and that upper level
4. A change in pressure at some upper level minus the change in mass between the surface and that upper level

1-57. Concerning the relationship between vorticity aloft and the deepening/filling of surface lows, all EXCEPT which of the following statements is correct?

1. Increasing cyclonic (positive) relative vorticity induces downstream surface pressure falls
2. Increasing anticyclonic (negative) relative vorticity induces downstream surface pressure rises
3. A wave will be stable if the 700-hPa wind over it possesses anticyclonic relative vorticity
4. A wave will be stable if the 700-hPa wind field over it possesses cyclonic relative vorticity